the second opposing surface of the layer of adhesive in substantially vertical orientation, the fiber first portions terminating in tips above the second opposing surface of the layer of adhesive; and

an encapsulant comprising a gel between the first portions of the fibers and over the adhesive.

5. The thermally conductive structure of claim 4 wherein the tips of the fibers extend to above the encapsulant.

6. The thermally conductive structure of claim 4 wherein the gel comprises a polymer.

7. The thermally conductive structure of claim 4 wherein the thermally conductive fibers are selected from the group consisting of carbon fibers, metal fibers, and ceramic fibers.

8. The thermally conductive structure of claim 4 wherein the thermally conductive fibers are selected from the group consisting of graphite fibers and diamond fibers.

9. The thermally conductive structure of claim 4 wherein the thermally conductive fibers are carbon fibers.

10. The thermally conductive structure of claim 4 wherein the encapsulant is on the second opposing surface of the layer of adhesive.

11. The thermally conductive structure of claim 4 wherein the fibers have second portions which extend downwardly to at or below the first opposing surface of the layer of adhesive.

12. A thermally conductive structure, comprising:

a layer of adhesive having a pair of opposing surfaces, the opposing surfaces being a first opposing surface and a second opposing surface;

a plurality of thermally conductive fibers embedded in the adhesive, the fibers having first portions which extend out of the second opposing surface of the layer of adhesive and upwardly from the second opposing surface, the first portions terminating in tips above the second opposing surface of the layer of adhesive, the tips being at a same height above the second opposing surface as one another; the thermally conductive fibers being selected from the group consisting of carbon fibers, metal fibers, and ceramic fibers; and

an encapsulant comprising a gel between the first portions of the fibers and over the adhesive.

13. The thermally conductive structure of claim 12 wherein the upwardly extending first portions are parallel to one another and perpendicular to the second opposing surface.

14. The thermally conductive structure of claim 12 wherein the thermally conductive fibers are carbon fibers.

15. The thermally conductive structure of claim 12 wherein the tips of the fibers extend to above the encapsulant.

16. The thermally conductive structure of claim 12 wherein the encapsulant is on the second opposing surface of the layer of adhesive.

17. The thermally conductive structure of claim 12 wherein the fibers have second portions which extend downwardly to at or below the first opposing surface of the layer of adhesive.

18. A thermally conductive structure, comprising:

a layer of adhesive having a pair of opposing surfaces, the opposing surfaces being a first opposing surface and a second opposing surface;

a plurality of thermally conductive fibers extending through the adhesive, the fibers having first portions which extend out of the second opposing surface of the layer of adhesive, the first portions extending upwardly from the second surface, the upwardly extending first portions being parallel to one another, the first portions terminating in tips above the second opposing surface of the layer of adhesive, the fibers having second portions which extend downwardly to at or below the first opposing surface of the layer of adhesive; the thermally conductive fibers being selected from the group consisting of carbon fibers, metal fibers, and ceramic fibers; and

a gel encapsulant between the first portions of the fibers and on the adhesive.

19. The thermally conductive structure of claim 18 wherein the tips are at a same height above the second opposing surface as one another.

20. The thermally conductive structure of claim 18 wherein the thermally conductive fibers are carbon fibers.

21. A thermally conductive structure, comprising:

a substrate layer having a pair of opposing surfaces, the opposing surfaces being a first opposing surface and a second opposing surface, the first and second surfaces being spaced from one another along a direction defined as a vertical direction;

a plurality of thermally conductive fibers embedded in the substrate layer, the fibers having first portions which extend upwardly out of the second opposing surface of the substrate layer in substantially vertical orientation, the fiber first portions terminating in tips above the second opposing surface of the substrate layer; and

an encapsulant between the first portions of the fibers and over the substrate layer, the encapsulant at least temporarily adhering to the first portions of the fibers.

22. The thermally conductive structure of claim 21 wherein the tips of the fibers extend to above the encapsulant.

23. The thermally conductive structure of claim 21 wherein the substrate layer is an adhesive.

24. The thermally conductive structure of claim 21 wherein the thermally conductive fibers are carbon fibers.

25. The thermally conductive structure of claim 21 wherein the encapsulant is a polymeric gel.

26. A thermally conductive structure, comprising:

a layer of adhesive having a pair of opposing surfaces, the opposing surfaces being a first opposing surface and a second opposing surface;

a plurality of flocked, thermally conductive fibers embedded in the adhesive, the fibers having first portions which extend upwardly out of the second opposing surface of the layer of adhesive in substantially vertical orientation;

an encapsulant between the first portions of the fibers and over the adhesive; and

a third surface defining an outermost surface of the thermally conductive structure except for the fiber first portions terminating in tips above the third surface and the encapsulant.

27. The thermally conductive structure of claim 26 wherein the encapsulant comprises a polymeric gel.

28. The thermally conductive structure of claim 26 wherein the third surface comprises a surface of the encapsulant.

29. The thermally conductive structure of claim 26 wherein the thermally conductive fibers are carbon fibers.

30. The thermally conductive structure of claim 26 wherein the fibers have second portions which extend downwardly to at or below the first opposing surface of the layer of adhesive.

31. A thermally conductive structure, comprising:

a layer of adhesive having a pair of opposing surfaces, the opposing surfaces being a first opposing surface and a second opposing surface, the first and second surfaces being spaced from one another along a direction defined as a vertical direction;

a plurality of flocked, thermally conductive fibers embedded in the adhesive, the fibers having first portions which extend upwardly out of the second opposing surface of the layer of adhesive in substantially vertical orientation, the fiber first portions terminating in tips above the second opposing surface of the layer of adhesive; and

an encapsulant comprising a gel over the adhesive, between the first portions of the fibers, and beneath free tips of the fibers.

DETAILED DISCUSSION

The International Search Report, a copy of which is attached, upon which the present petition relies, lists twelve documents considered to be relevant. The Blackmon, Fick, and Olsen documents are listed as defining the general state of the art but are not considered to be of particular relevance. Accordingly, such determination shows with particularity that the claimed subject matter is patentable over such references. Also, the two Koon documents are listed as having particular relevance regarding inventive step but are also stated to be published later than the priority date claimed. The present application to which this petition pertains claims the same priority date, namely, June 24, 1998. Accordingly, such determination particularly points out how the claimed subject matter is patentable over such references. The remaining seven references are discussed below.

The International Search Report lists U.S. Patent No. 4,459,332 issued to Giglia as a document of particular relevance in that the claimed invention cannot be considered novel or to involve an inventive step in light of Giglia alone. New claim 4 sets forth a thermally conductive structure including a layer of adhesive, a plurality of flocked, thermally conductive fibers embedded in the adhesive, and "an encapsulant comprising a gel" between the fibers. The fibers extend upwardly out of the adhesive and terminate in tips above a surface of the layer of adhesive. Giglia discloses an adhesive layer having activated

carbon fiber flocking positioned on the surface thereof away from an underlying fabric and activated carbon powder deposited in the void formed between the flocking. A second adhesive layer is superimposed on the fibers and a second fabric is superimposed on the second adhesive layer.

Notably, Giglia does not disclose or suggest "an encapsulant comprising a gel" as set forth in claim 4. While a variety of differently worded definitions may exist in the art for the term "gel" it is clear that "activated carbon powder" does not disclose or suggest "gel." Accordingly, claim 4 is patentable over Giglia. Claims 5-11 depend from claim 4 and are thus patentable over Giglia at least for such reason as well as for the additional limitations set forth in such claims and not disclosed by the documents cited in the Search Report. For example, claim 6 sets forth that "the gel comprises a polymer." Giglia does not disclose a gel comprising a polymer. Accordingly, claims 4-11 are patentable over Giglia.

The International Search Report lists PCT Publication No. WO 97/28044 issued to Berens as a document of particular relevance in that the claimed invention does not contain an inventive step when Berens is combined with one or more other documents, such combination being obvious to a person skilled in the art. Berens discloses carbon fiber material saturated with hydrocarbon solid-liquid phase change material to be used as thermal management materials. Nevertheless, Berens does not

disclose or suggest carbon fibers embedded in an adhesive as set forth in claim 4. Further, Berens also does not disclose or suggest "an encapsulant comprising a gel" as also set forth in claim 4. No disclosure whatever is provided in Berens that hydrocarbon solid-liquid phase change material comprises a gel.

Further, it is not inherent that such phase change material is a gel. "The mere fact that a certain thing may result from a given set of circumstances is not sufficient to establish inherency." In re Rijckaert, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993) (citations omitted) (emphasis in original). Further, "[i]n relying upon the theory of inherency, the Examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis added). Accordingly, Berens does not disclose every element set forth in claim 4 and claim 4 is patentable over Berens. Claims 5-11 depend from claim 4 and are thus also patentable over Berens at least for such reason as well as the additional limitations set forth in the claims and not disclosed by Berens. For example, claim 6 sets forth that "the gel comprises a polymer." Berens only discloses 32-carbon normal alkane dotriatontane as a hydrocarbon solid-liquid phase change material and such compound is not a polymer. Accordingly, claims 4-11 are patentable over Berens.

The International Search Report states that the remaining five references are of particular relevance in that the claimed invention does not involve an inventive step when the document is combined with one or more other documents, such combination being obvious to a person skilled in the art. U.S. Patent No. 5,695,847 issued to Browne discloses a thermally conductive film including fibers disposed in a polymeric matrix material. The film is made by cutting portions of composite prepreg material using a sheer/extruder apparatus. However, Browne does not disclose a layer of adhesive and a plurality of flocked, thermally conductive fibers embedded in the adhesive, as set forth in claim 4. Further, Browne does not disclose an encapsulant comprising a gel as set forth in claim 4 since uncured polymeric matrix material in the composite prepreg must be sufficiently solid to endure the repetitive sheering to form a film of thermally conductive material.

U.S. Patent No. 5,542,471 Dickinson discloses a heat transfer element having longitudinally thermally conductive fibers. The elements may be in the form of a plate or a flexible member, such as a cord. However, Dickinson does not disclose a layer of adhesive and a plurality of flocked, thermally conductive fibers embedded in the adhesive, as set forth in claim 4. Further, Dickinson does not disclose an encapsulant comprising a gel between the fibers.

U.S. Patent No. 5,014,161 issued to Lee discloses a second conductor pad used to conduct heat between a semiconductor dye and

a heat sink. However, Lee does not disclose a layer of adhesive and a plurality of flocked, thermally conductive fibers embedded in the adhesive, as set forth in claim 4. Lee also does not disclose an encapsulant comprising a gel.

U.S. Patent No. 5,077,637 issued to Martorana discloses a directional, thermal cable including a bundle of carbon fibers. However, Martorana does not disclose a layer of adhesive and a plurality of flocked, thermally conductive fibers embedded in the adhesive, as set forth in claim 4. Further, Martorana does not disclose an encapsulant comprising a gel.

U.S. Patent No. 5,674,585 issued to Ewing discloses a ceramic tile woven perpendicular to backing and a ceramic matrix material infiltrated in the ceramic fiber pile. However, Ewing does not disclose a layer of adhesive and a plurality of flocked, thermally conductive fibers embedded in the adhesive, as set forth in claim 4. Further, Ewing does not disclose an encapsulant comprising a gel between the fibers.

At least for the reasons discussed above, Browne, Dickinson, Lee, Martorana, and Ewing do not disclose each and every element set forth in claim 4. Accordingly, claim 4 is patentable over such documents. Claims 5-11 depend from claim 4 and are thus also patentable over such documents at least for their dependence on claim 4. Further, claim 5 sets forth that "tips of the fibers extend to above the encapsulant." None of the cited documents disclose fibers extending to above an

encapsulant comprising a gel. Accordingly, claims 4-11 are patentable over the cited documents.

New claim 12 sets forth a thermally conductive structure including a layer of adhesive, a plurality of thermally conductive fibers embedded in the adhesive, and an encapsulant comprising a gel between the fibers. Similar to claim 4, the fibers have first portions extending upwardly from the adhesive surface, terminating in tips above the surface. However, the tips are further at a same height above the adhesive surface as each other and the fibers are selected from among carbon, metal, and ceramic. Given the similarities of claim 12 to claim 4, claim 12 is also patentable over the cited references at least for the reasons set forth above regarding claim 4. Claims 13-17 depend from claim 12 and are similarly patentable over the cited references at least for such reasons as well as for the additional limitations set forth in such claims not suggested by the cited art.

New claim 18 sets forth a thermally conductive structure including a layer of adhesive, a plurality of thermally conductive fibers extending through the adhesive, and a gel encapsulant between the fibers and on the adhesive. Similar to claim 12, the fibers have first portions extending upwardly from the adhesive surface terminating in tips above the surface. However, the fibers further include upwardly extending first portions parallel to one another and second portions extending downwardly to at or below an opposing surface of the adhesive. The

fibers are selected from among carbon, metal, and ceramic. Accordingly, at least for the reasons set forth above regarding claim 4, claim 18 is also patentable over the cited references. Claims 19 and 20 depend from claim 18 and are further patentable at least for such reasons.

New claim 21 sets forth a thermally conductive structure including a substrate layer, a plurality of thermally conductive fibers embedded in the substrate layer, and an encapsulant between the fibers. The encapsulant at least temporarily adheres to first portions of the fibers which extend upwardly out of a surface of the substrate layer in substantially vertical orientation terminating in tips above the surface of the substrate layer. Neither Giglia nor Berens teach or suggest an encapsulant "at least temporarily adhering to the first portions of the fibers" as set forth in claim 21. Such a limitation is supported by the text of page 5 of the present specification describing how such a property of the encapsulant provides the advantage of enhancing thermal contact with the finished thermally conductive structure. Giglia does not provide any teaching or suggestion of activated carbon powder at least temporarily adhering to activated carbon fiber disclosed therein. Further, column 3, lines 22-26 expressly state that the activated carbon fibers form channels in the carbon powder "contributing to the transport of air and water vapor through the composite." Accordingly, Giglia expressly teaches against encapsulant at least temporarily adhering to fibers as set forth in claim 21.

Also, Berens does not provide any disclosure of hydrocarbon solid-liquid phase change materials at least temporarily adhering to carbon fiber material 16 disclosed therein. Further, it is not inherent that 32-carbon normal alkane dotriacontane at least temporarily adheres to carbon fiber material 16 disclosed therein. Thus, claim 21 is patentable over the cited art. Claims 22-25 depend from claim 21 and are further patentable at least for such reasons as well as for the additional limitations set forth therein not disclosed in the cited art. For example, claim 25 specifies that "the encapsulant is a polymeric gel." As discussed above, neither Giglia nor Berens disclose such an encapsulant. Further, none of Browne, Dickinson, Lee, Martorana, or Ewing teach or suggest an encapsulant "at least temporarily adhering to the first portions of the fibers," as set forth in claim 21.

New claim 26 sets forth a thermally conductive structure including a layer of adhesive, a plurality of flocked thermally conductive fibers embedded in the adhesive, an encapsulant between the fibers, and a third surface "defining an outer most surface of the thermally conductive structure." Further, first portions of the fibers terminates in tips above the third surface and above the encapsulant. Column 3, lines 1-6 of Giglia expressly provides a composite article wherein carbon fibers are positioned between outer fabric layers. Accordingly, Giglia does not disclose or suggest a third surface defining an outer most surface of the thermally conductive structure except for fiber terminating in tips above

the third surface, as set forth in claim 26. Berens and the other cited references further do not provide any disclosure of fiber tips terminating above an outer most surface of a thermally conductive structure. Accordingly, claim 26 is patentable over the cited art.

Claims 27-30 depend from claim 26 and are further patentable at least for such reasons. Further, claim 27 sets forth that the encapsulant comprises a polymeric gel, which is not disclosed or suggested in the art as discussed above. Claim 28 sets forth that "the third surface comprises a surface of the encapsulant." Such a feature is also not disclosed in Giglia, Berens, or the cited art.

New claim 31 sets forth a thermally conductive structure including a layer of adhesive, a plurality of flocked, thermally conductive fibers embedded in the adhesive, and "an encapsulant comprising a gel" between the fibers. The fibers extend upwardly out of the adhesive and terminate in tips above a surface of the layer of adhesive. Claim 31 further sets forth the encapsulant "beneath free tips of the fibers." Given the similarities to claim 4, claim 31 is patentable over the cited art at least for the reasons set forth above regarding claim 4, as well as the additional limitation of claim 31 not disclosed in the art.

Claims 4-31 are pending in the current application. Applicants assert that the above detailed discussion of the references particularly points out how the claimed subject matter is patentable over the references as required by 37 C.F.R. 1.111(b) and (c). Accordingly,

applicants request granting of the present Petition to Make Special for Accelerated Examination.

Respectfully submitted,

Dated: 27 Sep 2000 By: _____

James E. Lake
Reg. No. 44,854